

Lack of Association Between Breastfeeding and Preschool Age Overweight and at-Risk-for-Overweight Among Offspring of Gestational Diabetic Mothers — Michigan Birth Cohort, 1995–1999

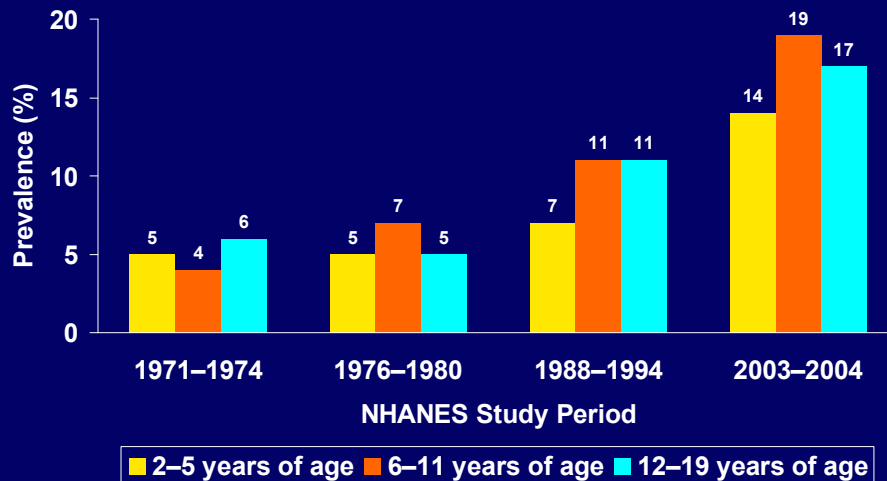
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Obesity and Overweight

- Ongoing epidemic in United States
- Major public health problem
- CDC terms for children
 - At-risk-for-overweight (AROW)
 - Overweight (OW)
- $BMI = wt \text{ (kg)} / [ht \text{ (m)}]^2$
- $AROW = BMI \text{ } 85^{th}\text{--}95^{th} \text{ percentile}$
- $OW = BMI \geq 95^{th} \text{ percentile}$

Prevalence of Overweight Among Children and Adolescents



Public Health Significance

- Overweight children
 - increased prevalence of cardiovascular (CV) risk factors
 - Reported that 58% had ≥ 1 CV risk factor
- Persists into adolescence and adulthood
- Obese adults at risk for a number of chronic diseases

Breastfeeding and Childhood Overweight

- Majority of studies report protective effect
- Limited studies in offspring of gestational diabetic mothers (OGDM)
- Recent study reported breastfeeding ≥ 3 months negatively associated with early childhood OW in OGDM

Gestational Diabetes (GD)

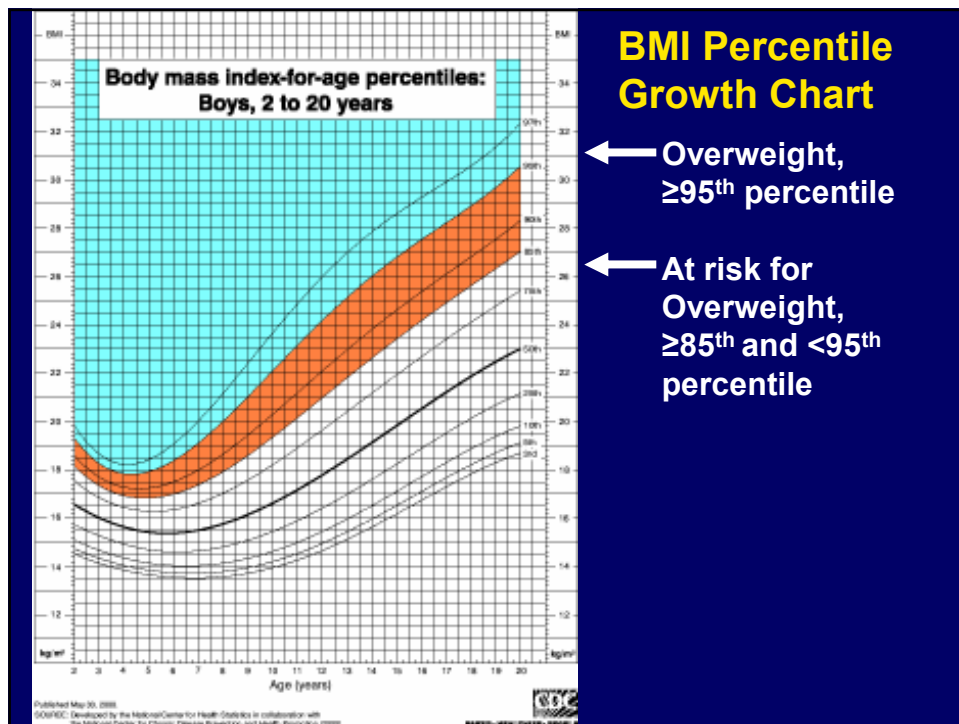
- Diabetes limited to pregnancy
- Most prevalent form of diabetes in pregnancy
- OGDM have increased risk for
 - Childhood OW
 - Impaired glucose tolerance
 - Type 2 diabetes

Objective

To determine whether breastfeeding was negatively associated with AROW or OW in population of preschool children who were OGDM

Inclusion Criteria

- **Mothers**
 - **Delivered live birth in Michigan, 1995–1999**
 - **Diagnosis of gestational diabetes (GD)**
 - **Enrolled in WIC**
- **Children**
 - **OGDM**
 - **Continuously enrolled in WIC through age 4**
 - **Available data**
 - **Breastfeeding history**
 - **Age 4 BMI percentile**



Main Study Variables

- Main exposure variable — **Ever breastfed**
- Main outcome variables
 - Overweight (**OW**): BMI percentile ≥ 95
 - Combined at-risk-for-overweight or overweight (**AROW / OW**): BMI percentile ≥ 85

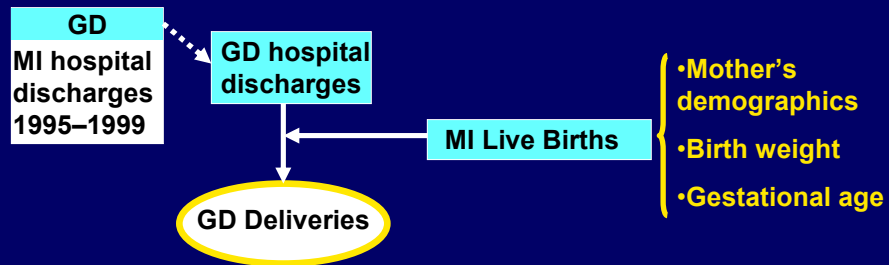
Analytic Methods

- Crude odds ratios (OR) calculated by using chi-square, Mantel-Haenszel statistics
- Adjusted ORs determined by logistic regression

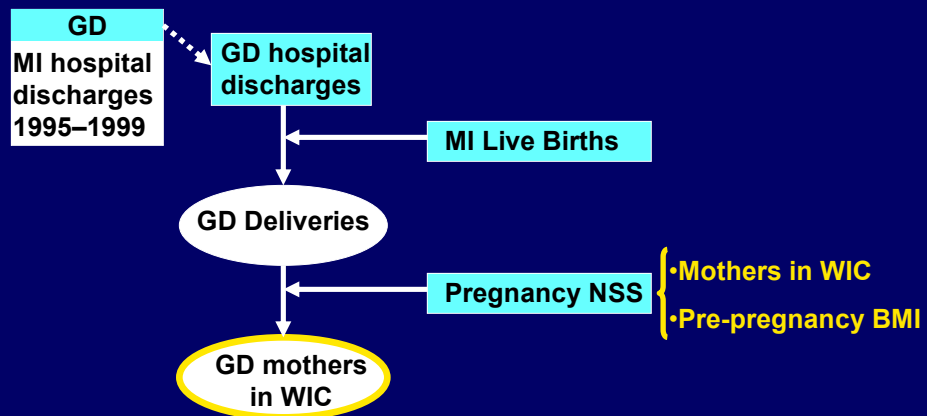
Data Set Linkage



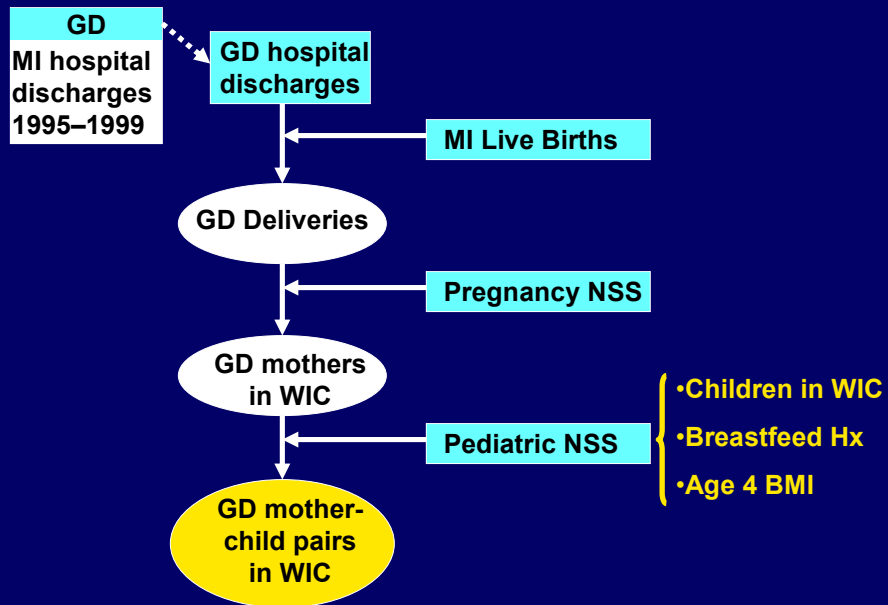
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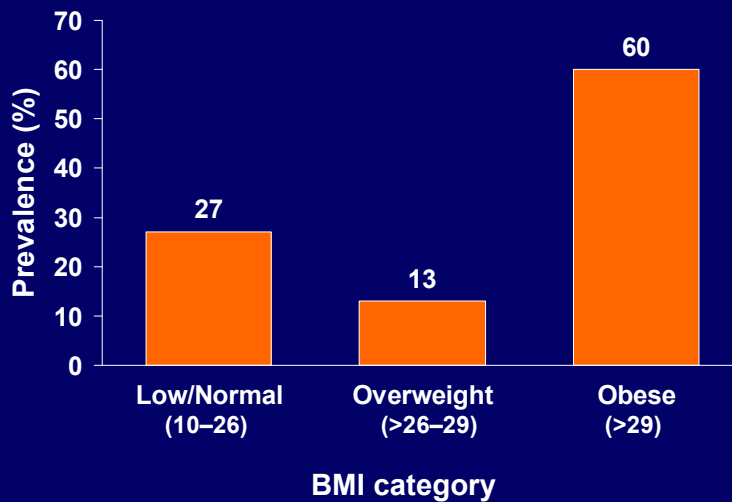
Characteristics of Mothers (n=1202)

Race/ethnicity	%
White	63
Black	25
Hispanic	10
Other	2

Characteristics of Mothers (n=1202)

Characteristic	%
Age, y	
<20	8
20–24	21
25–29	29
30–34	24
≥35	18
Education	
< High school	22
Completed high school	50
> High school	28

Mothers' Pre-Pregnancy BMI



Characteristics of Children (n=1202)

Characteristic	%
Sex	
Male	50
Estimated gestational age, wk	
Term (≥ 37)	84
Preterm (< 37)	16
Birth weight, g	
Normal (2,500–4,000)	74
High ($> 4,000$)	15
Low ($< 2,500$)	11

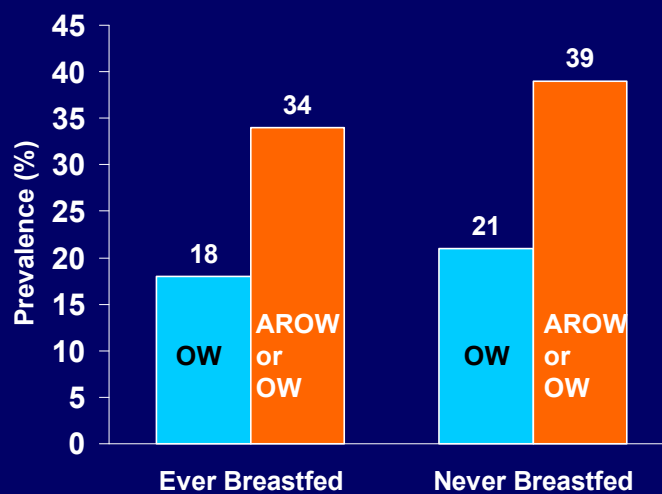
Prevalence of Main Study Variables Among Children (n=1202)

Study variable	%
Ever breastfed	47
Age 4 BMI percentile	
Underweight ($< 5^{\text{th}}$)	3
Normal ($5^{\text{th}} - < 85^{\text{th}}$)	60
AROW ($85^{\text{th}} - < 95^{\text{th}}$)	17
OW ($\geq 95^{\text{th}}$)	20

Prevalence of Main Study Variables Among Children (n=1202)

Study variable	%
Ever breastfed	47
Age 4 BMI percentile	
Underweight (<5 th)	3
Normal (5 th –<85 th)	60
AROW (85th–<95th)	17
OW (≥95th)	20
	37%

Prevalence of OW and AROW / OW Among Children by Breastfeeding Status



Crude Odds Ratios of Association Between Breastfeeding and OW and AROW / OW

Breastfeeding History	OW	AROW / OW
	OR (95% CI)	OR (95%CI)
Never Breastfed	ref	ref
Ever Breastfed	0.78 (0.58–1.04)	0.82 (0.65–1.04)

Adjusted* Odds Ratios of Association Between Breastfeeding and OW and AROW / OW

Breastfeeding history	OW	AROW / OW
	OR (95% CI)	OR (95% CI)
Never breastfed	ref	ref
Ever breastfed	0.80 (0.59–1.08)	0.84 (0.65–1.08)

*Adjusted for child's birth weight and gestational age, and mother's age, race/ethnicity, and pre-pregnancy BMI

Conclusions

- Prevalence of OW in this population of OGDM 20% versus 14% of all US children*
- Among OGDM, breastfeeding not protective against preschool age OW or AROW
- Results not in agreement with recent study

**NHANES data, 2003–2004*

Limitations

- Breastfeeding duration could not be studied
 - **Breastfeeding history** biased results to null
- Pediatric and Pregnancy Nutrition Surveillance Systems populated with programmatic data
- Data linkage might have excluded mother-child pairs
- Results might not be generalizable

Recommendations

- Study using **breastfeeding duration** as exposure needed for OGDM
- Breastfeeding should be encouraged among OGDM because of other benefits

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***Denotes study co-author**



The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.



Supplemental Slides

Breastfeeding Prevalence in US - NHANES

“On average, since 1970 approximately one-half of children born in the United States are reported to have been breast fed at some point, and about one-third have been breast fed for 3 months or more.”

From <http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/background.htm>

Adult Overweight and Obesity

- Overweight: BMI 25–29.9
- Obese: BMI ≥ 30
- Same criteria regardless of sex or age

Childhood Overweight –Associated Hospital Costs*

- Associated annual hospital costs in U.S. (1997–1999) estimated at \$127 million
- Childhood obesity-associated diseases reviewed from hospital discharge data
 - Obesity
 - Diabetes
 - Gallbladder disease
 - Sleep apnea

**Wang G, Dietz WH. Economic Burden of Obesity in Youths Aged 6 to 17 Years: 1979–1999. Pediatrics 2002;109(5):E81*

Adult Overweight and Obesity

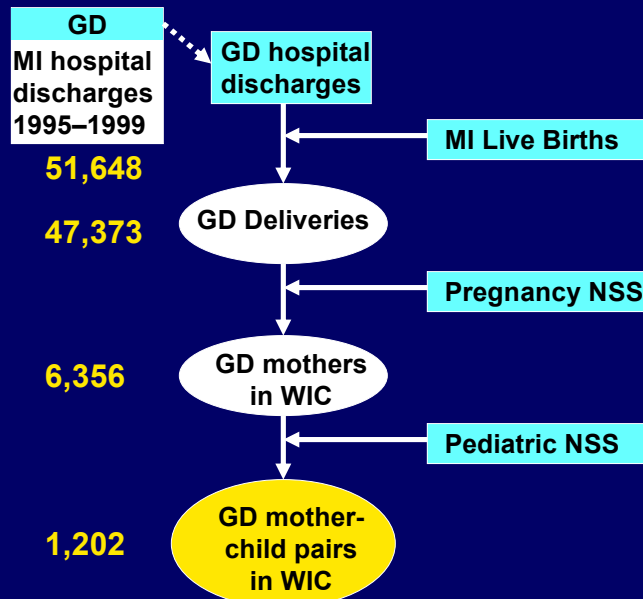
- Increased risk for many diseases
 - Hypertension
 - Type 2 Diabetes
 - Coronary Heart Disease
 - Stroke
 - Dyslipidemia
 - Osteoarthritis
 - Gallbladder disease
 - Sleep apnea and other respiratory problems
 - Cancer

Breastfeeding and Childhood Overweight in Offspring of Gestational Mothers

- Study of single German clinic population of 324 GDM mothers and offspring (mean age = 5.4 y)
- Exposure was exclusive breastfeeding
- Outcome was OGDM overweight (BMI ≥ 90 %)
- AOR = 0.55 (0.33–0.91) for breastfed >3 months
- Sub-group analysis: significant association only for obese mothers (BMI ≥ 30)

**Schaefer-Graf et al. Diabetes Care 2006;29(5):1105–1107*

Data Set Linkage



Study Ratios and Linkage

- Incidence of gestational diabetes (GD)
 - MI incidence (1995–1999) ~ 7.1%
 - U.S. annual incidence ~ 4% (per ADA)
- Percent of MI study mothers enrolled in WIC
 - 45% GD birth records matched WIC ID #
 - Per PRAMS — 39% of MI mothers enrolled in WIC (2003)
- Rough estimate of percent linkage of GD deliveries and WIC
 - Linked 21,373 records by birth certificate # and WIC ID #
 - Linked 6356 records by WIC ID # with PNSS
 - Successful linkage of $6356 / 21,373 = 30\%$

Benefits of Breastfeeding

- **Infant**
 - Protection from infectious diseases
 - Decreased mortality
 - Possible decreased SIDS
 - Possible decreased diabetes when older
- **Maternal**
 - Increased child spacing
 - Decreased risk breast and ovarian cancer
 - Financial savings (not buying formula)
- **Community**
 - Potential for decreased health care costs
 - Decreased environmental burden and energy demands

Prevalence (%) of Delivering Mothers' Race/Ethnicity

Race/Ethnicity	Study population	MI WIC 1997	MI overall 1997
White	63	62	74
Black	25	30	19
Hispanic	10	6	4
Other	2	2	3

Adjusted* Odds Ratios of Study Covariates

Covariate	(ref)	OW	AROW / OW
		AOR (95% CI)	AOR (95% CI)
Birthweight high	(normal)	1.6 (1.1–2.4)	1.5 (1.1–2.1)
Maternal age <20	(≥35)	2.0 (1.1–3.9)	2.5 (1.4–4.2)
Maternal age 20–24	(≥35)	1.5 (0.9–2.4)	1.3 (0.9–2.0)
Prepreg. BMI 26–29	(10–26)	1.8 (1.0–3.1)	1.3 (0.8–2.1)
Prepreg. BMI >29	(10–26)	2.5 (1.6–3.7)	2.2 (1.6–3.0)
Preterm birth	(term)	1.2 (0.7–1.9)	0.9 (0.6–1.4)
White	(black)	1.0 (0.7–1.4)	1.2 (0.9–1.6)
Hispanic	(black)	1.3 (0.8–2.2)	1.4 (0.9–2.3)

*Adjusted for child's birth weight and gestational age, and mother's age, race/ethnicity, and pre-pregnancy BMI

Adjusted* Odds Ratios of Association Between Breastfeeding and OW and AROW / OW by Race / Ethnicity

Breastfeeding Ever vs. Never	OW	AROW / OW
	AOR (95% CI)	AOR (95% CI)
White	0.66 (0.45–0.98)	0.73 (0.53–1.00)
Black	1.16 (0.60–2.23)	1.13 (0.64–2.00)
Hispanic	1.25 (0.47–3.33)	0.70 (0.29–1.69)
Other	3.30 (0.15–71.00)	4.92 (0.29–84.50)

*Adjusted for child's birth weight and gestational age, and mother's age and pre-pregnancy BMI

Overweight and Cardiovascular Risk Factors in Children and Adolescents*

- **Data from the Bogalusa (Louisiana) Heart Study**
 - Community-based study of CV risk factors in early life
 - Exams of children aged 5–17 years (1973–1994)
- **11% of schoolchildren overweight**
- **Study measures**
 - Total, HDL and LDL cholesterol; Triglycerides
 - Blood pressure
 - Fasting insulin
- **58% of overweight children had ≥ 1 CV risk factor**

**Freedman DS, Dietz HD, et al. Pediatrics 1999;103(6):1175–1182*

Does Breastfeeding Protect Against Pediatric Overweight?*

- **CDC study**
 - Data from PNSS and PedNSS (WIC data) in 7 states
 - Analyzed linked data for 12,587 mother-child pairs
 - Logistic regression for odds of OW at age 4 years
- **Dose-response, protective relationship for duration of breastfeeding with risk of OW among whites only**
- **Among non-Hispanic whites, AOR (95% CI) of OW by breastfeeding duration**
 - Breastfed 6–12 months: 0.70 (0.50–0.99)
 - Breastfed ≥ 12 months: 0.49 (0.25–0.95)

**Grummer-Strawn L, Mei Z. Pediatrics 2004;113(2):e81–e86*